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MILITARY STANDARD

RADAR OUTPUTS, NAVAL SHIP AND SHORE

DEPARTMENT OF THE NAVY
NAVAL SEA SYSTEMS COMMAND

Washington, DC 20362-5101

Radar Outputs, Naval Ship and Shore

1. This Military Standard is approved for use by the Naval Sea Systems Command, Department of the Navy, and is available for use by all Departments and Agencies of the Department of Defense.

2. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Sea Systems Command, SEA 55Z3, Department of the Navy, Washington, DC 20362-5101.

FOREWORD

It is the intent of this standard to establish revised requirements for multiplexed and analog outputs of Naval radar systems reflective of technological changes and advancements in current state of the art.

1. SCOPE

1.1 Purpose. This standard establishes and updates the basic requirements for the multiplexed and analog outputs of radar systems used in Naval surface ships, submarines and shore installations.

1.2 Application. The requirements of this technical standard are intended to be used in applying technological advances to new equipment designs for radar systems for various Naval ships and shore installations.

2. REFERENCED DOCUMENTS

2.1 Government documents.

2.1.1 Standard. Unless otherwise specified, the following standard of the issue listed in that issue of the Department of Defense Index of Specifications and Standards (DoDISS) specified in the solicitation forms a part of this standard to the extent specified herein.

WS 23037 Radar Signal Distribution Switchboard System
General Specification for

(Copies of standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Order of precedence. In the event of a conflict between the text of this standard and the references cited herein, the text of this standard shall take precedence.

3. DEFINITIONS

3.1 Radar mile. A radar mile is equal to 2,000 yards.

3.2 Radar trigger pulse. A radar trigger pulse is that pulse which is synchronized with the transmitted pulse of the radar set and used to initiate the active time for the display of radar pulse returns.

3.3 Video signal. A video signal is the signal output of a radar receiver, or other sensor of wide band amplitude modulated signals, that is locked with the time base of the sensor and intensity-modulates the cathode-ray tube of a radar indicator in the same time base.

3.4 Bearing signal. A bearing signal is the means used to convey azimuth position of the radar antenna to the radar indicator.

3.5 Peak pulse amplitude. A peak pulse amplitude (shown as E_{PA} on figure 1), is the maximum absolute value of a pulse, including spikes.

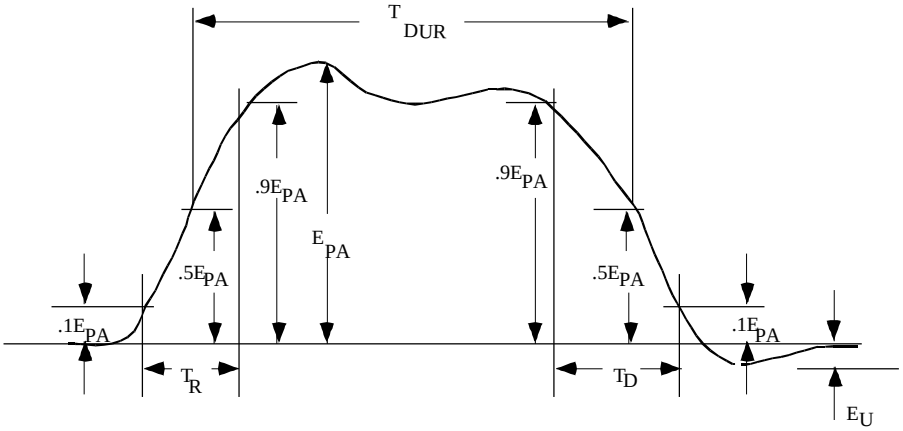

FIGURE 1. Pulse waveform.

3.6 Pulse decay. Pulse decay (shown as T_D on figure 1), is the interval between those points at which the instantaneous amplitude last reaches 90 percent and 10 percent of peak pulse amplitude.

3.7 Pulse duration. Pulse duration (shown as T_{DUR} on figure 1), is the time interval between the first and last instants at which the instantaneous amplitude reaches 50 percent of peak pulse amplitude.

3.8 Pulse jitter. Pulse jitter is the variation of the normal pulse spacing in a sequence of pulses.

3.9 Pulse repetition rate. Pulse repetition rate consists of the number of pulses or pulse trains generated per unit of time.

3.10 Pulse rise. Pulse rise (shown as T_R on figure 1), is the interval between the instants at which the instantaneous amplitude first reaches 10 percent and 90 percent of peak pulse amplitude.

3.11 Pulse spike. A pulse spike is an unwanted pulse of relatively short duration superimposed on the main pulse.

3.12 Unidirectional pulse. Unidirectional pulse is one in which pertinent departures from the reference level occur in one direction only.

3.13 Pulse edge undershoot. Pulse edge undershoot, (shown as E_U on figure 1), is the maximum instantaneous excursion of the pulse in the negative direction after the waveform crosses the base line following the main positive excursion of the waveform.

3.14 Pulse separation. Pulse separation is the interval between the 50 percent point of the trailing edge of one pulse and the 50 percent point of the leading edge of the succeeding pulse (pulse separation) as shown on figure 2.

3.15 Pulse spacing. Pulse spacing is the interval between the 50 percent point on the leading edge of the first pulse and the 50 percent point on the leading edge of the second pulse (pulse spacing) as shown on figure 2.

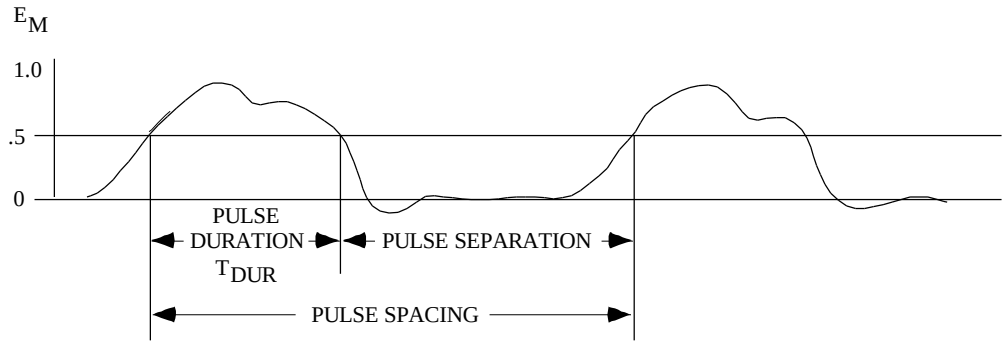

FIGURE 2. Two pulse waveform.

3.16 Pulse top. Pulse top is that portion of a pulse between the first and last instants at which the instantaneous amplitude reaches 90 percent of peak pulse amplitude.

3.17 Duty cycle. Duty cycle shall be calculated as follows:

$$100\% * \frac{1}{TA_{max}} \int_0^T A(t)dt$$

Where:

* is the multiplying operator,

A_{max} is the maximum current (or voltage),

A(t) is the current (or voltage) at t,
and
T is the time measurement of a periodic event, long enough to make the integral independent of T.

3.18 RADDS. RADDS is the acronym for a RAdar Display and Distribution System. Conventional Naval radar indicators, radar switchboards, data converters and amplifiers assembled and interconnected to work together in radar surveillance and navigation systems and not associated with a weapons system, are the basic elements of the RADDS.

3.19 RADDS digital data stream (RDS). The RDS is a digital data stream which begins with a Tm trigger, then a serial 64 bit digital data stream that contains radar azimuth and ship's navigation information, and optionally ends with triggers Te and Th/Tiff. See timing in figure 3.

3.20 Signal Data Converter (SCV). The definition of a SCV, as applied herein is a data converter that converts analog input signals from radar sets and navigation systems and multiplexes them into a serial digital data stream. The serial data stream of para 3.19 and para 5.5 is an example of the data conversion performed by an SCV and utilized by radar display and switchboard equipment.

3.21 LAN. Certain SCV configurations also digitize data for distribution over a LAN network.

4. GENERAL REQUIREMENTS (Not applicable)

5. DETAILED REQUIREMENTS

5.1 Radar output requirements. Radar systems designed and built for use by the Navy shall be in accordance with the standards herein.

5.1.1 Radar outputs. A radar system shall provide signals that operate a real time cathode-ray tube or flat display in a PPI or radar height indicator format:

(a) Analog videos;
(b) Radar triggers, stabilized or unstabilized azimuth data that can be multiplexed into a serial digitized format from a SCV.

5.2 Video requirements. Each radar set is required to provide one or more different analog video signals.

5.2.1 Video signal characteristics Each video shall have the following characteristics:

5.2.1.1 Polarity. The video shall be a unidirectional signal of positive polarity.

5.2.1.2 Peak amplitude. The peak amplitude of any video signal shall be 2.0 $\pm$ 0.5 volts measured across 75 ohms plus or minus 5 percent.

5.2.1.3 Trailing edge undershoot. The trailing edge undershoot of any video pulse shall be less than 5 percent of peak pulse amplitude.

5.2.1.4 Duty cycle. The duty cycle of signal plus noise shall be within the range from 0 to 70 percent.

5.2.1.5 Video output. The video signals from the radar set output shall be connected to standard Navy coaxial cable connectors. Sufficient electrical isolation shall be provided so that when any video output signal is grounded, all other video output signals shall remain within the limits as specified herein.

5.2.1.6 Video measurements. Video measurements shall be taken at the video output of the radar set, terminated with a 75 ohm ($\pm$ 5%) load.

5.3 Antenna bearing. Radar antenna analog (azimuth) bearing signals shall be transmitted from the radar set to an SCV for multiplexing into the RDS or to other users of analog bearing signals by one of the following methods:

(a) Five wire synchro, 60 hertz, for unstabilized bearing shall always be available from Navy radar sets.
(b) Voltage regulator VR sin alpha/VR cos alpha (VR is +/- 18.75 volts) sweep voltages for stabilized bearing.
(c) Parallel sine/cosine, a parallel digital stabilized bearing.
(d) Serial Digital Theta; ACP/ARP; Q-21 and UYA-4 format DX/DY/RM/EOS stabilized bearing data.
(e) Other stabilized bearing data.

5.4 Trigger requirements. Trigger requirements shall be as specified in 5.4.1 through 5.4.1.12.

5.4.1 Trigger pulses. A radar set shall provide Master Trigger (Tm; R0; Zrt). Additionally, it may provide one or more other Triggers. Surface Trigger (Tm2, Rss), Trigger (Th, Rsy), Trigger (TIFF), and Early Trigger (Te, EOS, Rmax, Pretrig). The analog trigger pulses shall have the following basic characteristics:

5.4.1.1 Polarity. The trigger shall be a unidirectional pulse of positive polarity.

5.4.1.2 Duration. The duration of the trigger pulse, shown as (T_{DUR}) on figure 1, shall be 1 to 10 microseconds (us).

5.4.1.3 Pulse amplitude. The peak pulse amplitude, shown as E_{PA} on figure 1, shall be 20 $\pm$ 5 volts measured across 75 ohms plus or minus 5 percent.

5.4.1.4 Rise time. The rise time, shown as T_R on figure 1, shall be less than 20 percent of pulse duration, shown as T_{DUR} on figure 1. At no time shall the rate of rise be less than 100 volts per us.

5.4.1.5 Decay time. The decay time, shown as T_D on figure 1, shall be less than three times the rise time or 1 us, whichever is greater.

5.4.1.6 Pulse top. The instantaneous value of the pulse top shall be not less than 80 percent of the peak pulse amplitude, shown as E_{PA} on figure 1, nor greater than the peak pulse amplitude.

5.4.1.7 Trailing edge undershoot. The trailing edge undershoot, shown as E_U on figure 1, of any trigger pulse shall be less than 5 percent of peak pulse amplitude.

5.4.1.8 Synchronization. The 50 percent of peak pulse amplitude point on the leading edge of the output trigger and the 50 percent of peak pulse amplitude point of the radar transmitted pulse shall be synchronized to within plus or minus 0.5 us.

5.4.1.9 Jitter. The jitter of the output trigger pulse, with respect to the radar transmitted pulse, shall not exceed 0.02 us.

5.4.1.10 Trigger output. The trigger pulses from the radar output shall be connected to standard Navy coaxial connectors.

5.4.1.11 Trigger output isolation. Sufficient electrical isolation shall be provided so that when any trigger output is grounded, all other output trigger pulses shall meet the requirements as specified herein.

5.4.1.12 Trigger measurements. Trigger measurements shall be taken at the trigger output of the radar set, terminated with a 75 ohm (± 5%) load.

5.5 RADDS serial data stream I and II. The CV-3989/SP converter generates RDS I and the CV-3989(V)1/SP converter generates RDS II

5.5.1 RADDS serial data stream composition. Both converters shall generate the RADDS serial data stream from analog radar trigger, azimuth, true bearing signals and ship's movement information. The serial data stream shall consist of pulse and digital information multiplexed into the form shown in figure 3.

5.5.2 Data stream format. The RADDS digital data stream shall be in the following format:

(a) A Tm pulse of 4 us duration shall initiate the RADDS data stream.
(b) Eight to 59 us after the leading edge of Tm, 64 data bits shall be transmitted in 128 us. (Note 1)
(c) Each data bit shall start at the beginning of a 2 us interval.
(d) The data stream shall be sampled 1 us after the leading edge of each data bit.
(e) A high (+5V) level at this point in time shall indicate a digital 1.
(f) A low (0V) level shall indicate a digital 0.
(g) Each data bit shall transmit at a +5V level for 500 ± 100 nanoseconds (ns) for a logic 0 or remain at a +5V level for 1500 ± 100 ns for a logic 1.
(h) Each data bit shall transmit at a low (0V) level before transmission of the next data bit.
(i) Te and Th/TIFF pulses shall be transmitted in the time gate of the data stream described in figure 3, and figure 3 notes
(j) Tm/Data are transmitted at a nominal +5V level; Te/Th/Tiff are transmitted at a nominal -5V level; baseline is 0V.

Note 1: In special cases, the 8 to 59 us may be increased, so long as the time from the last of the 64 bits to the next Tm doesn't exceed 100 us.

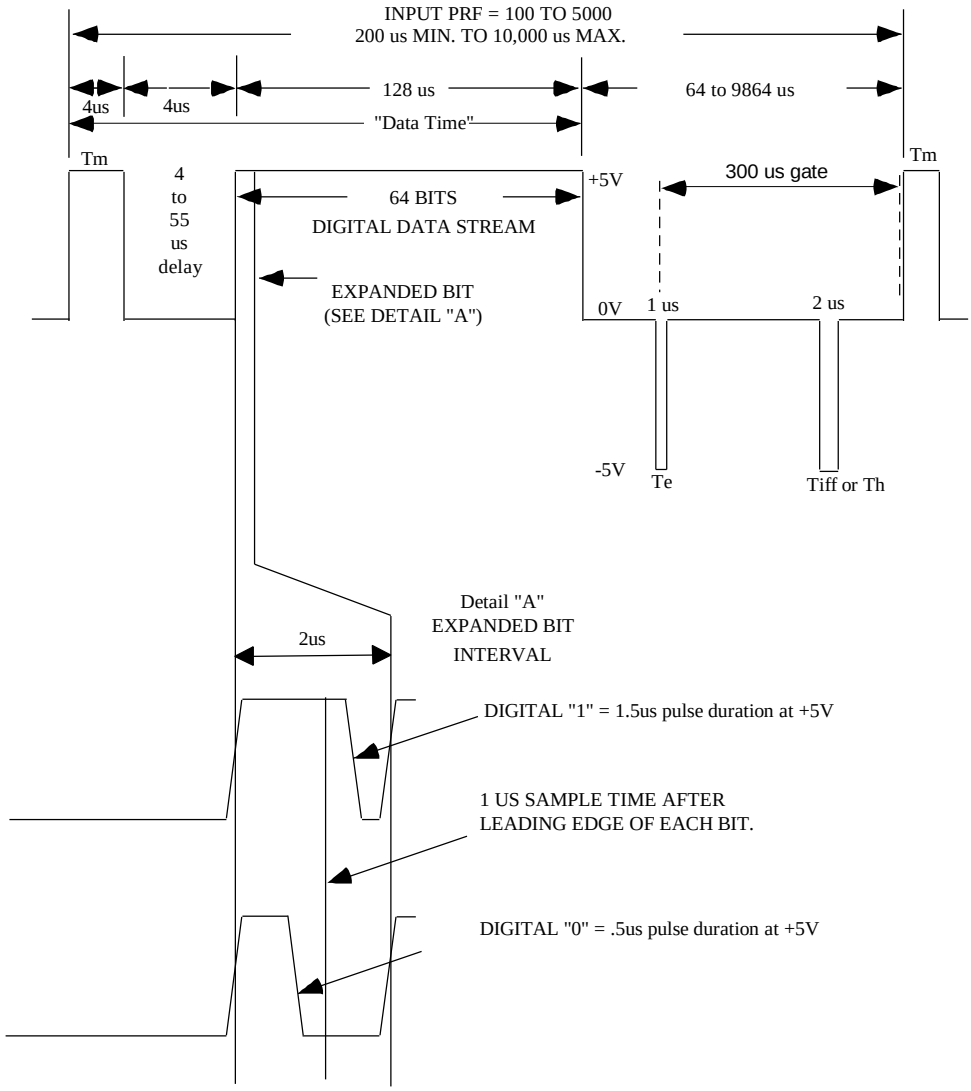

FIGURE 3. RADDS data stream I and II.

GENERAL NOTES FOR RADDS DATA STREAM I AND II

All numerical values are in microseconds unless otherwise indicated.
Tm = Radar Master Trigger Pulse
Te = Radar Early Trigger Pulse
Th = Radar Horizon Trigger Pulse
Tm and 64 data bits shall be transmitted in the RADDS data stream as positive going pulses at a nominal +5 V (with a tolerance of +6 volts to +4.5 volts).
Any Th or Te shall be transmitted in the RADDS data stream as negative going pulses at a nominal -5 V (with a tolerance of -6 volts to -4.5 volts).
The baseline (quiescent level) is 0V.

TIMING NOTES FOR RADDS DATA STREAM I

a. Any Te during "data time" (start of Tm to end of 64th bit) is delayed and is regenerated following the 64th data bit.
b. Cannot have a Th without a Te.
c. Can have a Te without a Th.
d. Any Te within 300 microseconds of a previous Te will be inhibited. A Te starts a 300 us window (gate) used for the conditions below. This 300 us "gate" can extend into "data time" depending upon Te/Tm relationship.
e. A Th within the 300 us gate of a Te generates a concurrent negative going pulse. If the generated Th falls within both the 300 us gate and the data time the Th is inhibited.
f. Any Th which is outside of the 300 us gate is delayed and is regenerated 25 us following the next Te.
g. Any negative going trigger which is not terminated 1 us prior to Tm inhibits that Tm and associated data.

TIMING NOTES FOR RADDS DATA STREAM II

a. Any Te during "data time" (start of Tm to end of 64th bit) is delayed and is regenerated following the 64th data bit.
b. Can have a TIFF without a Te.
c. Can have a Te without a TIFF.
d. Any Te within 300 microseconds of a previous Te will be inhibited. A Te starts a 300 us window (gate). This 300 us "gate" can extend into "data time" depending upon Te/Tm relationship.
e. Any negative going trigger which is not terminated 1 us prior to Tm inhibits that Tm and associated data.

5.5.3 Data bit assignment. Data assignment for the 64 digital bits of RADDS data stream I and II (RD I & II) shall be as listed in Tables I and II. RADDS data stream I reflects existing CV-3989/SP implementation. RADDS data stream II shall be incorporated for new equipment. It provides extended coverage of ownships navigation information, providing a form of Lat/Lon coordinates, data words for ships speed and heading, and contains the azimuth data in one field (bit 19-30) rather than the two separate fields for unstabilized and stabilized azimuth as is in RDS I. The sensor ID field in RDS II is also enlarged by one bit.

5.5.4 Electrical. The characteristics of the electrical transmission of the RADDS serial data stream are the same for RDS I and RDS II.

5.5.5 Fiber optic option.

5.5.5.1 Protocol. The protocol for the optical RADDS serial stream is the same as the electrical RADDS stream except that the stream intensity modulates an optical source instead of driving coaxial cable. The optical intensity modulation has three intensity states: maximum, middle, and minimum. The intensity of the optical RADDS stream is maximum when a main trigger or data bit high time is being transmitted. The intensity of the optical RADDS stream is minimum when an early or horizon trigger is being transmitted. The intensity of the optical RADDS stream is in the middle state during the quiescent state of the RADDS data stream.

5.5.5.2 Specification. The timing specifications for the optical RADDS serial stream are the same as the electrical RADDS stream. The electrical specifications however, are not applicable. The optical RADDS stream operates at a 1300 nm wavelength.

5.6 Radar outputs for raster scan displays (RSD). Video signals from radar sets for distribution to RSD shall be in analog form. Antenna bearing, ownships, and other navigation information shall be provided to RSD in the RADDS data stream.

5.6.1 RSD video. Raster scan displays shall accept three analog video signals from each radar set. Mixing and processing of the three video signals shall be accomplished within the RSD. One of the three videos may be IFF video, which can be displayed separately or mixed with one of the other two radar videos.

5.6.2 Azimuth information. The primary method for transmitting azimuth information from the radar set shall be 12 bit resolution digital words as contained in the RADDS data stream. If RADDS data stream is not available, such information shall be transmitted via the antenna 5 wire synchro signals.

5.6.2.1 True bearing indication. The radar set shall transmit a signal to the RSD indicating if the azimuth information provided is true or relative. The information shall be internally processed by the RSD to generate a correct display. Whenever a radar set supplies azimuth information to the RSD through the RADDS data stream, synchro amps shall not be required at the radar set. True bearing azimuth shall not be a requirement of the radar set output, but true bearing indication is required.

6. NOTES

6.1 Intended use. This military standard should be used by designers of Navy surface ship, submarine, and shore based radar equipment to specify the requirements for radar set signal outputs and the input signal requirements for radar indicators and displays.

6.2 Subject term (key word) listing.

Analog
Data bit assignment
Data stream format
Digital
RADDS (RAdar Displays and Distribution System)
RADDS data stream (RDS)
Raster scan displays (RSD)
Signal Data Converter (SCV)

Table I. RDS I bit assignment.

Bit Numbers	Bit/Field Description	Bit/Field Status
1	Video present bit for current Tm (Note 3)	0 = Present; 1 = Not Present (set by Th/Rsy)
2	Synchro Azimuth Valid	0 = Valid; 1 = not Valid
3 through 14	Synchro Azimuth data for next Tm (MSB is bit 3). (Note 4)	All bits 0 = 0^{O}; All bits 1 = 359.9^{O}. Each incremental step equals $.088^{O}$. Bit 3=180^{o}, 4=90^{o}, etc.
15 through 16	Reserved for future use	
17	True Bearing Indication	0 = Relative; 1 = True
18	Stabilized Azimuth Valid	0 = Valid; 1 = not Valid
19 through 30	Stabilized Azimuth data for next Tm (MSB is bit 19). (Note 4)	All bits 0 = 0^{O}; All bits 1 = 359.9^{O}. Each incremental step equals $.088^{O}$. Bit 19=180^{o}, 18=90^{o}, etc.
31	RDS ID Bit	0 = RDS II; 1 = RDS I
32	CQO (Ships Heading Marker bit)	Antenna Azimuth bits 19-30 are also used as the ships heading when a RDS has bit 32 set to "0"
33	CQO/SPEED Synchro inputs Valid	0 = Valid, 1 = Not Valid
34	DRA North (Note 2)	0 = 0; 1 = 2.78 yards due North
35	DRA South	0 = 0; 1 = 2.78 yards due South
36	DRA East	0 = 0; 1 = 2.78 yards due East
37	DRA West	0 = 0; 1 = 2.78 yards due West
38	Radar or Other sensor	0 = Other; 1 = Radar
39 through 43	Sensor Identification	See Sensor ID Table VI (Note 1)
44 through 63	Reserved for future use	
64	Even Parity Bit	

Note 1: Bit 43 in RDS I is always a logic "1", therefore only the section of the Sensor ID table (table VI) which has logic "1's" in bit position 43 is valid for CV-3989/SP units.
Note 2: Ships motion is output in four component vectors. A "1" indicates the ship has traveled 2.78 yards due North, South, East or West.
Note 3: Bit 1 is set to a "1" by trigger "Th/Rsy. It normally is used to instruct a display to "not paint" video for that data stream.
Note 4: Tm and azimuth data are captured in real time and inserted in a given data stream. Since the time for the entire data stream to occur requires a minimum of 132 us, the azimuth data is not available for the associated video in the radar range of 0 to 11 miles. For that reason, some displays use the previous azimuth data with current video, I. E., the displays grab the azimuth from a data stream and store it. When the next data stream comes along, the Tm from that stream, and associated video are used with the previously stored azimuth data.

Table II. RDS II bit assignment.

Bit Numbers	Bit/Field Description	Bit/Field Status
1	Video present bit for current Tm (Note 3)	0 = present; 1 = not present (set by Th/Rsy) (Always set to 0 in RDS II)
2 through 16	LSW Navigation/Heading Data bits	See Navigation Word Table IV
17	True Bearing Indication	0 = Relative; 1 = True
18	Azimuth Data Valid	0 = Valid; 1 = not Valid
19 through 30 (Note 4)	Best Azimuth data for next Tm. Stabilized Azimuth will be selected instead of Synchro if both are present. Bit 19 is MSB.	All bits 0 = 0^{O}; All bits 1 = 359.9^{O}. Each incremental step equals $.088^{O}$. Bit $19=180^{o}$, $18=90^{o}$, etc.
31	RDS I or RDS II select	0 = RDS II; 1 = RDS I
32	CQO (Ships Heading Marker bit)	Antenna Azimuth bits 19-30 are also used as the ships heading when a RDS has bit 32 set to "0"
33	CQO/SPEED Synchro inputs Valid	0 = Valid, 1 = Not Valid
34	DRA North (Note 2)	0 = 0; 1 = 2.78 yards due North
35	DRA South	0 = 0; 1 = 2.78 yards due South
36	DRA East	0 = 0; 1 = 2.78 yards due East
37	DRA West	0 = 0; 1 = 2.78 yards due West
38	Radar or Other Sensor	0 = Other; 1 = Radar
39 through 43	Sensor Identification	See Sensor ID Table VI
44	NAVDATA Available (Note 1)	0 = Data avail to read. Used with Navigation word table III.
45 through 47	Navigation Word Selection Table	See Navigation Word Table III
48 through 63	MSW Navigation/Speed/Elavation Data bits	See Navigation Word Table V
64	Even Parity Bit	

Note 1: When bit 44 is set to "0", Navigation word table III indicates what type of valid data is on the RDS.
Note 2: Ships motion is output in four component vectors. A "1" indicates the ship has traveled 2.78 yards due North, South, East or West.
Note 3: This function is not used in RDS II. The bit is always set to "0".
Note 4: Tm and azimuth data are captured in real time and inserted in a given data stream. Since the time for the entire data stream to occur requires a minimum of 132 us, the azimuth data is not available for the associated video in the radar range of 0 to 11 miles. For that reason, some displays use the previous azimuth data with current video, I. E., the displays grab the azimuth from a data stream and store it. When the next data stream comes along, the Tm from that stream, and associated video are used with the previously stored azimuth data.

Table III. Navigation word table.

RADDS DATA STREAM BITS				
Word ID Code			Description	Description
Bit 45	Bit 46	Bit 47	Bit 48 - 63 (MSW)	Bit 2 - 16 (LSW)
0	0	0	Ownships Speed in 1/100 of a knot	Ownships Heading
0	0	1	MSW of Ownships Latitude	LSW of Ownships Latitude
0	1	0	MSW of Ownships Longitude	LSW of Ownships Longitude
0	1	1	No Valid Data	No Valid Data
1	0	0	Elevation	No Data

Note: Speed/Elevation Word may be supplied more often than the Latitude and Longitude Words.
Note: See Tables IV and V for specific data bit assignment.
Note: Bit 44 must be set to "0" in the RADDS stream for which the table data will be valid.

Table IV. LSW Navigation Word Data Bit Assignments

Bit	*Heading Degree*	*Latitude LSW Degree*	*Longitude LSW Degree*
2	360/2	180/65536	180/65536
3	360/4	180/131072	180/131072
4	360/8	180/262144	180/262144
5	360/16	180/524288	180/524288
6	360/32	180/1048576	180/1048576
7	360/64	180/2097152	180/2097152
8	360/128	180/4194304	180/4194304
9	360/256	180/8388608	180/8388608
10	360/512	180/16777216	180/16777216
11	360/1024	180/33554432	180/33554432
12	360/2048	180/67108864	180/67108864
13	360/4096	180/134217728	180/134217728
14		180/268435456	180/268435456
15		180/536870912	180/536870912
16		180/1073741824	180/1073741824

Table V. MSW Navigation Word Data Bit Assignments

Bit	*Speed Knot*	*Elevation Degree*	*Latitude MSW Degree*	*Longitude MSW Degree*
48	32768/100	180/2	N/S*	E/W*
49	16384/100	180/4	180/2	180/2
50	8192/100	180/8	180/4	180/4
51	4096/100	180/16	180/8	180/8
52	2048/100	180/32	180/16	180/16
53	1024/100	180/64	180/32	180/32
54	512/100	180/128	180/64	180/64
55	256/100	180/256	180/128	180/128
56	128/100	180/512	180/256	180/256
57	64/100	180/1024	180/512	180/512
58	32/100	180/2048	180/1024	180/1024
59	16/100	180/4096	180/2048	180/2048
60	8/100		180/4096	180/4096
61	4/100		180/8192	180/8192
62	2/100		180/16384	180/16384
63	1/100		180/32768	180/32768

* South or West if bit is set (logic 1); North or East if bit is cleared (logic 0).

Table VI. Sensor ID table.

Sensor ID	RADDS Data Stream Bits				
	43	39	40	41	42
LAMPS	1	0	0	0	0
AN/SPS-67	1	0	0	0	1
AN/SPS-55	1	0	0	1	0
AN/SPS-10	1	0	0	1	1
AN/SPS-64	1	0	1	0	0
LN-66	1	0	1	0	1
Trainer	1	0	1	1	0
AN/SPS-49	1	0	1	1	1
AN/SPS-40	1	1	0	0	0
AN/BPS-16	1	1	0	0	1
AN/SPS-48	1	1	0	1	0
AN/SPS-52	1	1	0	1	1
AN/SPS-39	1	1	1	0	0
AN/BPS-15	1	1	1	0	1
AN/SPS-65	1	1	1	1	0
MK92	1	1	1	1	1
NO ID	0	0	0	0	0
AN/SPN-42	0	0	0	0	1
AN/SPN-43	0	0	0	1	0
AN/SPS-58	0	0	0	1	1
AN/SPS-61	0	0	1	0	0
APS-137	0	0	1	0	1
AN/SPN-41	0	0	1	1	0
Spare	0	0	1	1	1
Spare	0	1	0	0	0
Spare	0	1	0	0	1
AN/FPS-117	0	1	0	1	0
SRQ-4	0	1	0	1	1
AN/SPY-1	0	1	1	0	0
AN/SPS-73	0	1	1	0	1
AN/SPQ-9	0	1	1	1	0
MK23 TAS	0	1	1	1	1

CONCLUDING MATERIAL

Preparing activity:
Navy - SH(Project 5840-N216)